

Environmental Specimen Bank Activities

Environmental specimen banking is the long-term preservation of representative environmental specimens for deferred analysis and evaluation. A systematic well-designed specimen bank program is not only a valuable component of real-time monitoring and basic research, but it also enables investigators to extend their research into the past and provides for future verification of analytical results. Formal environmental specimen banks are recognized internationally as integral parts of long-term environmental monitoring and research.

P.R. Becker, R.S. Pugh, M.B. Ellisor, A.J. Moors, B.J. Porter, J.R. Kucklick, S.J. Christopher, S.S. Vander Pol, R.D. Day, W.C. Davis, J.M. Keller, D. Point, A. Guichard, J.R. Flanary, J.E. Yordy, C.E. Bryan, M.M. Schantz, G.C. Turk, and S.A. Wise (Div. 839)

NIST maintains two facilities for the cryogenic banking of environmental specimens collected as part of ongoing research and monitoring programs of other government agencies. Established in 1979, the National Biomonitoring Specimen Bank (NBSB) is located at the NIST Center for Neutron Research, Gaithersburg, Maryland campus. A second facility, the Marine Environmental Specimen Bank (Marine ESB), was established by NIST in 2002 at the Hollings Marine Laboratory (HML), Charleston, South Carolina. The Marine ESB is devoted to the cryogenic banking of marine and coastal environmental specimens. The major agency supporters of the Marine ESB are the National Oceanic and Atmospheric Administration (NOAA) and the U.S. Department of the Interior (DOI).

The NIST environmental specimen banks include well-developed banking protocols, computerized sample tracking (chain-of-custody) systems, maintenance of many forms of data associated with original specimens, and large investments in state-of-the-art facilities and equipment required to store specimens over relatively long periods of time. Both banks emphasize cryogenic storage using ultra-cold (-80°C) electric freezers and liquid nitrogen vapor (-150°C) freezers with continuously monitored security systems.

The National Marine Mammal Tissue Bank, which was established by federal legislation in 1992, is maintained by NIST for the National Marine Fisheries Service and the Fish and Wildlife Service as a component of the NBSB and Marine ESB, with the Marine ESB providing the lead.

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Tissue samples for banking are collected from individual stranded animals, mass strandings, and animals incidentally taken in commercial fishing operations; as part of unusual mortality event investigations; from Alaska Native subsistence hunts; and as part of on-going live-capture and release studies of marine mammal population health. At present, NIST maintains 3,017 tissue samples collected from 1,075 individuals representing 43 species of marine mammals from throughout U.S. coastal waters, including Alaskan. Since establishing the Marine ESB, NIST has used its banking expertise to develop protocols and to collect and archive blood and blubber samples for NOAA's ongoing bottlenose dolphin health assessment studies, to collect eggs as part of a DOI environmental monitoring program on Alaska seabird colonies, and to collect eggs and feathers as part of a DOI peregrine falcon monitoring program. To date, blood and blubber have been collected from 364 bottlenose dolphins, 1,031 eggs have been archived from 5 species of arctic seabirds throughout Alaska, and 102 samples of eggs and feathers have been collected from the peregrine falcon program.

From 1985 until 1992, the NBSB provided for the banking of fish tissues, sediments, mussels, and oysters as part of NOAA's National Status and Trends Program. During this period, 194 sediments, 197 mussels/oysters, and 31 fish tissue specimens from ~300 U.S. coastal sites were banked. Banking for this program ended in 1992 when NOAA funding support ended. Realizing the value of the banking component of this program, some funding was restored and banking of mussels and oysters began again in 2005 and continued through 2006, with the lead being provided by the Marine ESB. Since 2005, mussel and oyster collections have been banked from 73 sites from throughout the coastal U.S.

The Hollings Marine Laboratory (HML) is operated by the National Centers for Coastal Ocean Science (NCCOS), with a mission to "provide science and biotechnology applications to sustain, protect, and restore coastal ecosystems, with emphasis on links between environmental condition and the health of marine organisms and humans." HML partnership organizations include NIST, the National Oceanic and Atmospheric Administration (NOAA), the South Carolina Department of Natural Resources, the Medical University of South Carolina, and the College of Charleston.

The primary function of the NIST environmental specimen banks is to provide samples for retrospective analysis. A major effort at the HML involves the identification and investigation of newly emerging contaminants of concern in the marine environment. The banked specimens provide a valuable resource for investigating temporal environmental trends in concentrations of such compounds and for determining patterns of past exposure in marine biota. Geographic and time-trend studies using banked marine mammal tissues and seabird eggs are being conducted for brominated flame retardants, such as polybrominated di-

phenyl ethers (PBDEs) and hexabromochlorododecane (HBCD), organomercury, butyltin compounds, and perfluorinated compounds. Banked Alaska marine mammal specimens were also accessed in 2006 for stable isotope and fatty acid analyses in a study investigating food web changes that might be associated with climate changes.

Environmental specimen banking was recognized in November 2005 by the International Environmental Specimen Bank Symposium, held in Charleston, South Carolina, and at the Hollings Marine Laboratory. The three-day symposium and half-day workshop attracted 80 participants representing 8 countries (Germany, Japan, Canada, Sweden, France, Finland, South Africa, and the U.S.). Selected papers based on presentations at the symposium were published in a special issue of the *Journal of Environmental Monitoring* (Volume 8, Number 8, August 2006).

Impact: The establishment of the Marine ESB in association with the HML has provided a renewed interest and expansion in specimen banking as part of marine environmental monitoring and health research. Additional specimen types have been added to the bank and additional sponsors have contributed to the expansion of the banking program with primary interest in use of banked specimens for investigating newly emerging environmental contaminants.

Future Plans: NIST will continue to work with HML partners and other federal agencies and partners to expand environmental specimen banking activities. NIST is working with these partners to add serum banking as part of aquatic animal disease investigations. Existing specimens archived in the NBSB and Marine ESB are being identified for future work to measure new contaminants of interest as related to issues on ocean and human health.